



December 28, 2004

Dorothy Shimer
Research Division
Air Resources Board
P.O. Box 2815
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Ab1173@listserv.arb.ca.gov

Re: Air Resource Board's Draft Report to the California Legislature: Indoor Air Pollution in California (November, 2004 Draft for Peer Review).

Dear Ms. Shimer:

The American Solvents Council (Council) of the American Chemistry Council (ACC) appreciates the opportunity to comment on the revisions the Air Resources Board (ARB) has incorporated into the November, 2004 *Draft for Peer Review Report to the California Legislature: Indoor Air Pollution in California* (hereafter "November 2004 Draft"). The Council represents major U.S. manufacturers of hydrocarbon and oxygenated organic solvents,¹ and was formed to address health, safety, and environmental issues that affect producers and users of such solvents. The Council has previously commented on the June, 2004 Draft Report for Public Comment.² The comments in this letter address the revisions made by ARB in response to the Council's initial comments, and sets out the Council's continuing concerns about the November 2004 Draft's balance, objectivity and scientific validity.

OVERVIEW OF COMMENTS

The Council believes that the revisions to the June 2004 Draft Report for the most part represent improvements. However, the November 2004 Draft in many areas falls well short of

¹ The Council includes the following companies: The Dow Chemical Company; ExxonMobil Chemical Company; Shell Chemical LP; Eastman Chemical Company; Sasol North America, Incorporated; CITGO Petroleum Corporation; and Lyondell Chemical Company.

² The Council's initial comments on the June 2004 Draft Report are attached as Appendix A.

adequately addressing the concerns presented in the Council's initial comments. The Council believes that the November 2004 Draft requires further revision to provide a balanced, objective and scientifically valid assessment of potential health effects from indoor air exposures. The Council's comments make the following five points:

- I. The November 2004 Draft still fails to assess adequately potential health risks because it fails to compare indoor air VOC concentrations to relevant health benchmarks.
- II. The November 2004 Draft, though improved, continues to present a misleading impression of VOC health risks because it lumps VOCs together in a single, undifferentiated group.
- III. The November 2004 Draft's prioritization scheme, while improved, still fails to represent accurately the relatively minor risks and costs associated with indoor air VOC exposure.
- IV. The November 2004 Draft still fails to explain adequately that its estimate of excess cancer cases from indoor air VOCs is very conservative and probably greatly overestimates actual risks, which could be zero.
- V. The November 2004 Draft does not demonstrate a need for new legislative authority to regulate VOCs.

COMMENTS

- I. THE NOVEMBER 2004 DRAFT STILL FAILS TO ASSESS ADEQUATELY POTENTIAL HEALTH RISKS BECAUSE IT FAILS TO COMPARE INDOOR AIR VOC CONCENTRATIONS TO RELEVANT HEALTH BENCHMARKS.

The June 2004 Draft Report, while generally concluding that indoor air concentrations of VOCs pose a serious health risk, for the most part failed to support this conclusion with actual determinations of risk – i.e. by demonstrating that indoor concentrations of VOCs exceed relevant health benchmarks. The June 2004 Draft Report devoted much attention to the fact that indoor air exposures for many compounds exceed outdoor air exposures, but for the most part failed to take the critical step of comparing indoor air concentrations to relevant health benchmarks. The Council recommended that ARB include references to relevant health benchmarks in the Report, since only by comparing measured indoor air concentrations to relevant health benchmarks can the actual risks of indoor air exposure be evaluated. In response to this suggestion, some relevant health benchmarks were added to the November 2004 Draft. However, as discussed below, many of these revisions still fail to adequately describe, and consequently accurately represent, risk levels.

1. The discussion of toluene exposure on page 66 now includes the sentence: "These concentrations are below the chronic inhalation REL for toluene, 300 $\mu\text{g}/\text{m}^3$ (OEHHA, 2003a)." However, no further discussion of this reference value is presented. This

makes it impossible for the reader, without performing calculations, to ascertain that the maximum toluene exposures reported, 4000 µg/day, were actually less than one half the exposure (9360 µg/day) that can be derived from OEHHA's chronic REL.³

2. In addition, the report fails to mention that the maximum toluene exposures reported are less than one third the exposure one would receive if exposed to toluene at the U.S. EPA's proposed inhalation reference concentration (RfC) of 400 µg/m³.⁴
3. Similarly, the discussion of chloroform exposure on page 65 now includes the parenthetical "(The chronic REL for chloroform is 300 µg/m³ (OEHHA, 2003a)," but with no additional discussion. Further, the November 2004 Draft still fails to mention that the total combined oral and inhalation dose of 2.65 µg/day reported in the study cited by ARB, Kerger, *et al.*, 2000, is more than 250-fold below the U.S. EPA IRIS oral reference dose for chloroform.⁵ Thus, the revision fails to inform the reader that the exposure information presented by ARB is not indicative of a significant health risk.
4. The discussion of butoxyethanol (BE) exposure on page 68 now includes a reference to Zhu *et al.* (2001), and the following sentence has been added: "This is below the U.S. EPA's RfC for BE of 13 mg/m³, the daily inhalation exposure that is likely to be associated with an appreciable risk of deleterious effects during a lifetime (U.S. EPA, 1999c)." Again, there is no further discussion of the fact that measured concentrations are 1/30th the level deemed to present no risk, and that consequently the levels reported in Zhu *et al.* pose no health concern. Further, there is still no mention of the large margin of safety between this maximum concentration level and exposure levels found to pose no appreciable risk by both U.S. EPA and California.
5. The sentence "Only acetone (29 µg/m³) was present at a concentration above 10 µg/m³" was added to the November 2004 Draft's discussion of Gorman *et al.* (1999), a report that lists the highest median indoor air concentrations of 12 VOCs. But again, the November 2004 Draft fails to include readily available information indicating that many of the VOCs reported have 100 to 1000-fold safety margins. Inclusion of this information is critical in enabling the reader to make sound assessments of the nature and scope of any indoor air concerns.

As described in the Council's initial comments, and above, comparisons of measured concentrations to relevant health benchmarks demonstrate that indoor air VOC exposure generally poses no widespread health risk. Essentially the same conclusion is drawn by Hodgson and Levin (2003), cited by ARB, which states in its conclusion that "only a small number of the more than 100 reported VOCs [reviewed in this study] were shown to exceed levels that might be of concern with respect to the comfort and health endpoints considered." This report also states that only "for a very few compounds...[is] the evidence based on sensory irritation and chronic toxicity... sufficient to warrant efforts to reduce and otherwise control these compounds

³ The chronic REL can be converted to an exposure (dose) by assuming an inhalation rate of 1.3 m³/hr for 24 hours (300 µg/m³ · 1.3 m³/hr · 24 h/day = 9360 µg/day). This conversion conservatively assumes exposure at the chronic REL level 24 hours a day for a lifetime.

⁴ See Appendix A, Section III for calculation.

⁵ U.S. EPA's IRIS oral reference dose (RfD) is 10 µg/kg/day. For a 70 kg adult, this represents a daily exposure of 700 µg/day, which is 264 times greater than the combined dose of 2.65 µg/day cited by ARB.

in buildings.” Finally, Hodgson and Levin conclude that “[of] the small number of relatively potent, measured VOCs, only acrolein, which is emitted by tobacco and wood smoke, was shown to substantially exceed its irritation level indoors.” Thus only a single VOC of the more than 100 reviewed in this publication even exceeded irritation levels, and this VOC is more appropriately addressed as a component of tobacco smoke. (See also Section II, discussing that the characterization of “VOCs” as presenting health risks as a group is misleading.)

The Council acknowledges that the November 2004 Draft contains several additional references to relevant health benchmarks, and that this is an improvement over the June Draft Report. However, the mere inclusion of benchmarks, with no additional discussion to put these benchmarks into perspective, does little to help the reader accurately assess the potential risk, if any, posed by exposure to indoor air. This is especially true in cases where a comparison requires the reader to perform conversion calculations because the measured concentration is reported in different units than the relevant health benchmark. Thus, the Council believes the November 2004 Draft still requires substantial revision to provide the reader with the information necessary to place the reported indoor air concentrations in their proper context. Without such information, the reader likely will be unaware of the fact that indoor air VOC exposures typically pose little to no health risk. Moreover, since the relevant information for the most part is readily available in publications already cited by ARB in the November 2004 Draft or other public sources there simply is no reason not to present it in the report.

As mentioned in the Council’s initial comments, Assembly Bill 1173 directs ARB to present “[t]he best scientific information available including, but not limited to, the most recent empirical data, on indoor air pollution...” for chemicals that may pose health risks.⁶ Failing to include available relevant health benchmarks, which would permit the reader to make meaningful determinations of potential health risks, does not meet this standard. To be fully transparent, balanced and objective, the November 2004 Draft should provide this information. Stated differently, failing to include this readily available information creates the appearance that the November 2004 Draft is not transparent, balanced and objective.

II. THE NOVEMBER 2004 DRAFT, ALTHOUGH IMPROVED, CONTINUES TO PRESENT A MISLEADING IMPRESSION OF VOC HEALTH RISKS BECAUSE IT LUMPS “VOCS” TOGETHER IN A SINGLE, UNDIFFERENTIATED GROUP.

The June 2004 Draft Report’s general treatment of VOCs was overly simplistic and misleading because it tended to lump all VOCs, a group of tens of thousands of compounds with widely varying physical, chemical and toxicological properties, into a single category. The Council recommended that, to avoid creating the misperception that all VOCs present a health risk, when in fact data shows that the vast majority of VOCs pose little to no health risk, this indiscriminate lumping of VOCs be replaced with references to specific compounds or groups of compounds for which hazard and exposure information support a concern. Specifically, the Council suggested that the ARB eliminate broad references to VOCs in the June 2004 Draft, and: 1) make clear that VOCs comprise tens of thousands of diverse compounds; 2) explain that many VOCs are naturally present and are of low toxicity and; 3) replace many references to “VOCs”

⁶ See AB 1173, Section 2.

with references to specific compounds or categories. Incorporating these changes would prevent the misconception that all VOCs present a significant health risk.

Some of the Council's specific suggestions were incorporated into the November 2004 Draft. For example, the heading "Toxic Air Contaminants" was changed to "Toxic Air Contaminants and Other Indoor Air Pollutants," (pages 8 & 59) and references to "other VOCs" in Table ES-3.1 were changed to "some other VOCs" in Tables ES-3.1 & 3.2 and 6.1 & 6.2. Also, the statement "many of the VOCs found in indoor air in California are carcinogenic" was replaced with "Some of the VOCs found in indoor air in California have been identified as TACs based on their carcinogenic potential" (page 64). In addition, the reference on page 4 referring to "several links between asthma symptoms and volatile organic compounds..." was moved and changed to "A more recent review of indoor pollution studies further identified several links between asthma symptoms and specific volatile organic chemicals (VOCs), especially formaldehyde." These changes do, in some measure, mitigate the misconception that all VOCs present health risks, and thereby improve the November 2004 Draft's accuracy and balance.

However, most references to "VOCs" in the text were not replaced with references to specific compounds or groups. The explanation given for not making these replacements was that VOCs are "too numerous to list individually" and that "[c]onsideration would be given to individual compounds if any actions are developed to mitigate this group" (page 8 of ARB Responses to Public Comments). It is because VOCs are so numerous, with most presenting no health risk, that they should not be lumped into a single, undifferentiated category. Broad references to "VOCs" imply that VOCs present a widespread health problem, but as discussed in Sections I and III, the best available data do not support this implication. The Council reiterates that broad references to "VOCs" should be eliminated in favor of specific chemicals or groups of chemicals, *and then only to the extent supported by underlying data*. For example, the reference to "VOCs: cancer" in Table ES-2 on p. 11 (and in similar tables later in the Report) should be changed to "Selected Known or Suspected Carcinogens," and a footnote should be added to explain that "the cost estimate is the sum of cost estimates derived for [#] compounds that have been classified by one or more agencies as known or suspected carcinogens." Reference to the status of these compounds as "VOCs" is not necessary and is misleading because their cancer classifications are not based on their status as VOCs. Unless revisions of this nature are made, the numerous and continual references to "VOCs" as a group, even if referring to "some other" VOCs, will mislead the reader about the true nature and scope of the potential health effects of the vast majority of VOCs. (See also Sections I and III.)

In addition, the November 2004 Draft states on page 35 that "indoor and outdoor air pollution have been identified as potentially important contributors to [a tremendous] increase of asthma" over the last few decades. This statement is unclear given that "indoor and outdoor air pollution" is overly broad and undefined. The Council believes the November 2004 Draft should point out that several studies have shown that while air pollution has generally decreased over the past 30 years, asthma incidence has increased, even in areas with relatively low levels of air pollution. (e.g. Weiss, 1993; Crater, 1998; Barnes, 1994; Platts-Mill and Squillace, 1997).⁷

⁷ Weiss, 1993. Breathing or wheezing worse: The changing epidemiology of asthma morbidity and mortality. Annual Rev Publ Health 14: 491-513; Crater, 1998. Searching for the cause of the increase in asthma. Curr Opin Pediatr 10: 594-599; Barnes, 1994. Air pollution and asthma. Postgrad Med J 70: 319-325; Platts-Mill and Squillace, 1997. Allergen sensitization and perennial asthma. Int. Arch. Allergy. Immunol. 113: 83-86.

Moreover, the Institute of Medicine conducted a comprehensive assessment of the relationship between asthma causation and exacerbation and exposure to a number of biological and chemical exposures in indoor air.⁸ This assessment found that while sufficient evidence exists to establish a link between asthma development and the presence of house dust mites and tobacco smoke, there were insufficient or inadequate data to indicate a causal relationship between asthma development and exposure to any of the chemicals evaluated (including pesticides, plasticizers and VOCs). The Council believes that, to provide a complete and balanced analysis of the potential link between VOCs and asthma, the November 2004 Draft should cite and discuss these, and related references.

III. THE NOVEMBER 2004 DRAFT'S PRIORITIZATION SCHEME, WHILE IMPROVED, STILL FAILS TO REPRESENT ACCURATELY THE RELATIVELY MINOR RISKS AND COSTS ASSOCIATED WITH INDOOR AIR VOC EXPOSURE.

The June 2004 Draft Report failed to adequately group and prioritize chemicals by the health risks they pose. The Council recommended that the June 2004 Draft's prioritization scheme be revised substantially to provide a more balanced and objective assessment of potential priorities for future research and/or risk reduction measures. Specifically, ARB did revise the prioritization scheme to some extent, dividing the single Table ES-3 into two tables representing medium (ES-3.1) and high (ES-3.2) priority respectively and alphabetizing the chemicals within each table to remove the appearance of a prioritization scheme within the tables. In addition, the November 2004 Draft includes a list of factors considered in prioritizing the chemicals as "medium" or "high" priority. This too represents an improvement over the June Draft Report. However, this list of factors is qualitative only, and provides little guidance on how different factors are weighted, or which combination factors resulted in a specific chemical's priority designation. This qualitative, unclearly defined prioritization scheme is of limited use to the reader. The Council still believes that no product, or group of products, should be listed as "high" priority unless it can be demonstrated that exposures exceed or can be reasonably anticipated to exceed relevant health benchmarks.

The November 2004 Draft states that "preliminary indoor air pollution cost estimates provided in this report were considered, but were not weighted heavily in the prioritization because they primarily reflect the availability of cost information and the length of time a given pollutant, such as ETS and radon, has been studied, not necessarily the actual extent of exposure and risk in California." Though not weighted heavily, the estimated cost data nonetheless make a strong case that VOCs as a group (see discussion in Section II above) should *not* be designated as a high priority. Table ES-2 indicates that tobacco smoke, radon and sick building syndrome account for about 97% of the costs of indoor air pollution, while "VOCs: cancer"⁹ are estimated to be responsible for less than 2% of estimated costs of indoor air pollution. Even the 2% figure

⁸ Committee on the Assessment of Asthma and Indoor Air, Division of Health Promotion and Disease Prevention, Institute of Medicine. Clearing the Air: Asthma and indoor air exposures. National Academy Press, Washington, DC. 2000.

⁹ See related discussion on p. 5 concerning use of the phrase "VOCs: cancer."

is likely to be a substantial overestimate, because, as discussed in Section IV, the excess cancer rates themselves are highly conservative estimates based on upper bound cancer potencies. Thus, even when upper bound estimates of potential cancer risks are considered, VOCs are still relatively insignificant compared to other indoor air pollution concerns.

The prioritization scheme should focus spending for research and risk reduction measures on those chemicals that will provide the greatest reduction in risk for the investment. With this in mind, the review by Hodgson and Levin (2003), cited by ARB, recommends that “future studies to characterize VOC concentrations and exposures in buildings focus their resources on measurements of those compounds that are most likely to impact occupants as determined by the objectives of the investigations” and states that “[t]he lists of target compounds likely would be relatively small.” In addition, Hodgson and Levin conclude that “for a very few compounds, such as acrolein¹⁰ and formaldehyde,¹¹ the evidence based on sensory irritation and chronic toxicity is sufficient to warrant efforts to reduce and otherwise control the sources of these compounds in buildings.”

Given the small number of VOCs that present a potential health risk, and the small overall percentage of health costs associated with indoor VOC exposure, “VOCs” as a group should not be designated as high priority. (See also Section II above.) Rather, as suggested by Hodgson and Levin (2003), and as stated above, only individual chemicals known to present a significant health risk (e.g. exposures exceeding or likely to exceed relevant health benchmarks) should be designated as high priority.

The November 2004 Draft states on page 19 that “A quantitative prioritization was not undertaken because such an effort is beyond the scope of this report. Such an effort would be an appropriate step prior to taking action under a comprehensive program to address indoor sources.” Thus, ARB would defer a quantitative prioritization until implementation of a “comprehensive program.” However, as described above, the type of prioritization the Council suggests is necessary to determine whether such a “comprehensive program” is required in the first place. To do otherwise would risk squandering limited resources to regulate chemicals that present little or no health risk.

IV. THE NOVEMBER 2004 DRAFT STILL FAILS TO EXPLAIN ADEQUATELY THAT ITS ESTIMATE OF EXCESS CANCER CASES FROM INDOOR AIR VOCs IS VERY CONSERVATIVE AND PROBABLY GREATLY OVERESTIMATES ACTUAL RISKS, WHICH COULD BE ZERO.

The June 2004 Draft Report failed to disclose the fact that the estimate of excess cancer cases due to VOCs in indoor air was derived from upper bound cancer potency estimates for individual compounds that by design greatly overstate likely cancer risks. The Council recommended that this part of the June 2004 Draft be substantially revised to avoid the

¹⁰ The primary indoor air source of acrolein is tobacco smoke, and should therefore be treated under a “tobacco smoke” designation for risk and cost calculations, and not lumped with “VOCs.”

¹¹ Formaldehyde, also a component of tobacco smoke, has been the subject of a great deal of investigation and regulatory attention.

misleading impression that the stated estimate of excess cancer cases is a likely value, when it is in fact a very conservative (health protective) estimate.

Specifically, the Council identified several highly misleading statements about the estimated number of excess cancer cases attributable to indoor VOCs (see Appendix A, Section II), and recommended that the report include a more balanced discussion of the fact that these estimates likely overestimate cancer risk because they were derived from upper bound cancer potency estimates. In response, the November 2004 Draft was revised to include the following sentences on pages 38-39:

The 1994 CCRP estimates, like other cancer risk estimates, were derived using 95% upper-bound cancer potency factors, combined with measured indoor exposure distributions. Cancer risk methodology based on upper-bound cancer potency estimates provides a common, protective basis for comparing risks across topic areas. However, the risk estimates should not be interpreted as predictions of actual disease (CCRP, 1994). The risk can be much lower, depending on the actual dose of the pollutant inhaled and absorbed, and other factors.

The Council believes that, while this brief discussion represents an improvement over the June Draft Report, it does not provide nearly enough context for the reader to accurately interpret the reported excess cancer case estimates. Moreover, the last sentence is misleading because the qualifier “depending on the actual dose of the pollutant inhaled and absorbed” implies that the risk estimate might be inaccurate only if exposure assumptions are inaccurate. It does not acknowledge the possibility, in fact the likelihood, that potential risks could be much lower because the *underlying cancer potency estimates* are highly conservative and likely overstate the risks by an order of magnitude or more.

The Council’s initial comments included a detailed discussion of an article cited in the June 2004 Draft by Lance Wallace of U.S. EPA’s Atmospheric Research and Exposure Assessment Laboratory (Wallace, 1991).¹² In this article, Wallace expressly acknowledged that his VOC risk calculations, which, like those included in the June 2004 Draft, were based on upper-bound potency estimates derived from animal studies, are typically seven to ten-fold higher than mean potency estimates. Wallace also provided a discussion of the uncertainty surrounding risk estimates and acknowledged that “[f]or some of these chemicals, it is also possible to argue that the best estimate of risk is 0” and that “[e]ven if the risk is not 0, the estimates could easily be wrong by factors of 10, 100, or more.” Moreover, Wallace recognized that cancer risk assessments based on mean cancer potencies are also conservative, because they assume animal-to-human relevance and high-to-low dose linearity. Thus, even estimates based on mean cancer potencies *by design* likely overstate actual human cancer risks, particularly from the low exposures typically found in indoor and outdoor air. As a result, true excess cancer risks may be zero, and if not zero, could be 10 or 100-fold below even mean estimates. No discussion of this nature was included in the text of the November 2004 Draft. To provide full transparency, the Report should include a much more complete discussion of Wallace (1991), including the points summarized in this paragraph and the specific text quoted in this paragraph.

¹² Wallace L, 1991. Comparison of risks from outdoor and indoor exposure to toxic chemicals. Environmental Health Perspectives 95: 7-13. See Appendix A, Section II.

The Council reiterates that the November 2004 Draft should include a much more detailed discussion of the uncertainties inherent in estimating potential excess cancers and the highly conservative nature of its upper-bound excess cancer estimates – particularly since the information needed for this discussion is readily available in a publication already cited in the draft report. Without such a discussion, the November 2004 Draft continues to present a misleading view of actual excess cancer risks posed by exposure to indoor air. As stated in the Council’s initial comments, a more balanced discussion would lead to the conclusion that any excess cancer risks are limited to a relatively small number of compounds, and even for these compounds, risks likely are far below upper-bound estimates and could be zero. Such a conclusion would invite more focused research to determine whether cancer risks may indeed be elevated for some compounds based on current use information, and more focused risk reduction measures targeted specifically to those substances, if any, that are shown to pose significant risks.

V. THE NOVEMBER 2004 DRAFT DOES NOT DEMONSTRATE A NEED FOR NEW LEGISLATIVE AUTHORITY TO REGULATE VOCs.

The central premise of the November 2004 Draft is that indoor air quality presents serious health concerns that require comprehensive new legislative authority to address, including new authority to regulate consumer products. The information presented in the Draft Report does not support this central premise. Despite the November 2004 Draft’s continued grouping of VOCs into a single, undifferentiated category, a comparison of measured indoor air concentrations to relevant health benchmarks indicates that the (vast) majority of VOCs present little or no health risk. This is supported by the results of independent scientific studies. As such, ARB has not demonstrated that additional legislation is needed to adequately protect persons from indoor air VOC exposure. On the contrary, focusing on regulating “VOCs” is likely to divert limited resources away from more hazardous air pollutants, such as tobacco smoke and radon.

CONCLUSION

The Council is pleased to have this opportunity to comment on the revisions to the June 2004 Draft Report. The Council appreciates the extensive effort that the ARB staff has invested in both the initial development of the Report and in evaluating comments and making revisions to the Report. The Council also acknowledges and appreciates that a number of the suggestions in its comments were incorporated in the November 2004 Draft. At the same time, the Council is concerned that several of its most substantial suggestions either were not implemented, or only partially implemented in the November 2004 Draft. The Council believes the incorporation of its suggestions is essential not only to the transparency, balance and objectivity of the Report, but to the Report’s presenting the “best scientific information available” as directed by Assembly Bill 1173. Accordingly, the Council respectfully urges ARB to reconsider the Council’s comments, as reiterated in this letter, and make further, appropriate revisions to the November 2004 Draft.

If you require additional information or have questions concerning these comments, please contact me at (703) 741-5609 or by email at:
Barbara_Francis@americanchemistry.com.

Sincerely,

A handwritten signature in black ink that reads "Barbara Francis". The script is cursive and elegant, with the first letters of each word being capitalized and prominent.

Barbara O. Francis
Managing Director,
American Solvents Council

Appendix A



August 18, 2004
(revised August 24, 2004)

Dorothy Shimer
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Re: Draft Report to the California Legislature: Indoor Air Pollution in California

Dear Ms. Shimer:

The American Solvents Council (Council) of the American Chemistry Council (ACC) is pleased to submit comments on the Air Resources Board's (ARB) *Draft for Public Review of the Report to the California Legislature: Indoor Air Pollution in California* as required by Assembly Bill 1173 (Keeley, 2002; Cal. Health & Safety Code § 39930) (hereafter "Draft Report").¹

STATEMENT OF INTEREST

The Solvents Council is part of the American Chemistry Council and represents major U.S. manufacturers of hydrocarbon and oxygenated organic solvents.² The Council was formed to address health, safety, and environmental issues that affect producers and users of hydrocarbon and oxygenated solvents. The Council has supported research pertaining to the role VOCs may play in ozone formation under different environmental conditions, and has worked with federal and state agencies on the development of effective policies and strategies for addressing tropospheric ozone-related problems. In particular, the Council has played an active role in the U.S. EPA's Reactivity Research Work Group, including its science and policy task groups, and ARB's Reactivity Research Advisory Committee.

¹ ARB's Draft Report to the California Legislature: Indoor Air Pollution in California circulated for public review in June 2004 and posted on ARB's website at:
http://www.arb.ca.gov/research/indoor/ab1173/Report_06-30-04.htm

² The Solvents Council includes the following companies: The Dow Chemical Company; ExxonMobil Chemical Company; Shell Chemical LP; Eastman Chemical Company; Sasol North America, Incorporated; CITGO Petroleum Corporation; and Lyondell Chemical Company.

Over the years, members of the Council also have sponsored numerous toxicological studies to support safety assessments for individual oxygenated and hydrocarbon solvents. Many of these studies have been designed and conducted in cooperation with the U.S. Environmental Protection Agency, and the results of studies are typically published in the peer-reviewed literature. Further, under ACC policy, final copies of toxicological studies sponsored under the ACC umbrella are provided as a matter of course to numerous federal agencies. Council members also have supported health assessments of numerous oxygenated and hydrocarbon solvents by federal and state agencies. Such assessments have included reviews of numerous compounds under the international OECD Screening Information Data Set (SIDS) program³, and sponsorship of several compounds under EPA's Voluntary Children's Chemical Evaluation Program (VCCEP).⁴ The OECD SIDS and VCCEP assessments have included information on potential exposures as well as hazard information.

Members of the American Solvents Council support the safe use of oxygenated and hydrocarbon solvents.

OVERVIEW OF COMMENTS

The Solvents Council appreciates the efforts that have been undertaken to prepare the Draft Report. The Table of References (35 pages) reflects the enormous scope of the project and extraordinary amount of information that had to be reviewed and evaluated to respond to the charge set forth in Assembly Bill 1173. The Council believes, however, that the Draft Report requires extensive revision to provide a balanced and objective assessment of potential health effects from indoor air exposures. The Council's comments make the following four points:

1. The discussion of "VOCs" (volatile organic compounds) throughout the Draft Report is overly simplistic and could easily be misleading. VOCs are not a single chemical category, but are comprised of literally tens of thousands of compounds with widely varying physical, chemical and toxicological properties. The vast majority of VOCs are present in indoor air at very low levels (if at all) and do not present any health concerns. The Draft Report, however, tends to lump all VOCs together and gives a very negative impression of VOCs as a whole. Most references to "VOCs" in the Draft Report should be replaced with references to specific compounds or groups of compounds for which hazard and exposure information support a concern.

2. The Draft Report fails to recognize that the estimate of excess cancer cases due to "VOCs" in indoor air is based on upper bound cancer potency estimates derived for individual compounds that by design overstate likely cancer risks (to be health protective). Actual excess cancer cases from this handful of compounds are likely to be far lower than upper

³ The SIDS process is part of an international program sponsored by the Organization for Economic Cooperation and Development for collecting and sharing health and environmental effects information for certain high production volume compounds.

⁴ 65 Federal Register 81700 (Dec. 26, 2000).

bound estimates, and could be zero. Substantial revisions are necessary to this part of the Draft Report to avoid the misleading impression that is now created.

3. The discussion of indoor air concentrations of VOCs is incomplete and could be misleading. The Draft Report should be expanded to present available data on indoor air concentrations, and should compare those concentrations to relevant health benchmarks. Much attention is given to the fact that indoor air exposures for many compounds exceed outdoor air exposures, but this fact, while true, does not answer the key question: how do indoor air exposures compare to relevant health benchmarks? The Draft Report for the most part fails to present the information that is necessary to answer that question, even though a substantial amount of information is available in references cited in the Draft Report.

4. The prioritization schemes presented in the Draft Report need to be revised substantially. Environmental tobacco smoke clearly should be given a higher priority than is indicated in tables in the Draft Report, and much more attention should be given to biological agents, as well. "Organic chemicals" are inappropriately lumped into a single category of "pollutants," when of course organic chemicals are not a single category at all, and it is clearly not scientific to label all organic chemicals as "pollutants." Further, in the "prioritization of pollutant sources for mitigation," "building materials and furnishings" and "consumer products" are treated as single categories when they clearly represent a wide range of products that comprise literally hundreds of very different categories and subcategories. These overly broad categories should be subdivided into smaller categories of related products. Further, the prioritization scheme should distinguish between high, medium and low priorities, and no product or group of products should be in a "high priority" category without some demonstration that exposures exceed or can reasonably be anticipated to exceed relevant health benchmarks.

The Council urges the ARB to revise the Draft Report to provide a more balanced, objective and transparent discussion of potential health effects from indoor air exposures. The Draft Report contains many broad statements that appear justified for very few indoor air contaminants (if any). The final report should provide a more rigorous assessment of indoor exposures and potential health effects, and should focus attention on those indoor exposures for which available data demonstrate a reasonable basis for concern. In that way, the final report will provide a more balanced and credible assessment of indoor air quality, and will provide a sound basis for identifying further research needs and/or directing risk reduction measures to activities that truly present significant health concerns.

COMMENTS

I. THE DRAFT REPORT PROVIDES A MISLEADING IMPRESSION OF “VOCs”; MOST REFERENCES TO “VOCs” SHOULD BE REPLACED WITH REFERENCES TO SPECIFIC COMPOUNDS OR CATEGORIES OF COMPOUNDS FOR WHICH AVAILABLE DATA DEMONSTRATE A CONCERN

VOCs (volatile organic compounds) are not a single chemical category. VOCs are comprised of tens of thousands of compounds with widely varying physical, chemical and toxicological properties. The vast majority of VOCs are present in indoor air at very low levels (if at all) and do not present any health concerns. The Draft Report, however, tends to lump all VOCs together and gives a very misleading and negative impression. Most references to “VOCs” in the Draft Report should be replaced with references to specific compounds or categories of compounds for which available hazard and exposure information demonstrate a concern. To the extent the final report includes any discussion of “VOCs,” it should explain clearly that the term encompasses tens of thousands of compounds having diverse physical, chemical and toxicological properties. Further, the final report should recognize that many VOCs are naturally present in the environment and in our food, and many VOCs used in consumer products have been demonstrated to have relatively low toxicity. It is misleading to make general statements about the potential health effects of “VOCs” as if they represent a single category of compounds. While many published studies refer to “VOCs,” they typically are talking about a relatively small number of compounds that have been studied in indoor air.

In the following paragraphs, we highlight specific references to “VOCs” that are overly broad and misleading and should be changed or removed. (The examples set forth below are not exhaustive. ARB is urged to review the entire Draft Report with this concern in mind.)

1. The Draft Report (p. 7) treats VOCs as a subset of toxic air contaminants. Most VOCs are not toxic air contaminants, and it is wrong to imply that they are. The reference to “VOCs” should be replaced with references to specific compounds or categories of compounds, to the extent supported by underlying data.

2. Table ES-2 (p. 10) under “Health End Point” lists “VOCs: cancer.” The table implies that all VOCs are carcinogens, which is not true. The table should refer to “Carcinogens.” The same comment applies to Table 3.2 (p. 81) and Table 3.3 (p. 85), and any other place in the Draft Report where cancer from “VOCs” is discussed (see, e.g., the misleading reference to “VOC-related cancer cases” on p. 82, and the inappropriate reference to “230 cancer cases due to VOCs” on the same page). The text should refer to “cancer cases attributable to chemicals classified as “known or probable carcinogens,” and should give examples of chemicals so classified. (See discussion in the next section of these comments concerning upper bound estimates of excess cancer cases.)

3. References to “VOCs” in table ES-3 (p. 17) are overly broad for reasons already explained. All these references should be eliminated and replaced by references to specific compounds or categories (when supported by data).

4. The statement that “many of the VOCs found in indoor air in California are carcinogenic” (p. 54) is inaccurate. The absolute number of known or suspected carcinogens is relatively small and represents only a tiny fraction of all VOCs. Further, the statement in the next sentence that “there is no level of exposure to these chemicals that is known to be absolutely safe” is perhaps true in a technical sense in that there is no such thing as “zero risk,” but from a risk assessment standpoint, it provides no guidance because even for substances that are “known” human carcinogens there is an exposure level below which risks are deemed insignificant. Thus, there are exposure levels for compounds classified as known, probable and possible carcinogens that regulatory agencies consider effectively “safe” and not worthy of any regulatory response. The quoted sentence in the Draft Report should be deleted.

5. Other examples of overly broad references to “VOCs” are found on pages 4 (referring to “several links between asthma and volatile organic chemicals (‘VOCs’)”; page 30 (“VOCs” are identified as having “possible, but insufficient evidence” of a link to asthma); and page 49 (“Foremost among these pollutants [toxic air contaminants] are formaldehyde, VOCs, environmental tobacco smoke, radon . . .”).

II. THE DRAFT REPORT SHOULD EXPLAIN THAT ITS ESTIMATE OF EXCESS CANCER CASES FROM INDOOR AIR IS AN UPPER BOUND ESTIMATE; ACTUAL RISKS ARE LIKELY TO BE MUCH LOWER AND COULD BE ZERO

The Draft Report states that “about 230 excess cancer cases due to VOCs from indoor exposures are estimated to occur in California each year.” (p. 82) The Report estimates the cost of premature deaths from these excess cancer cases is \$730 million/year. The Report asserts these are “conservative” estimates because risks from exposure to radon and certain other compounds are not included. The Summary (p. 133) goes so far as to state, “At least 230 excess cancers per year are estimated to occur in California due to indoor carcinogens from residential and consumer sources . . .” Collectively, these statements are highly misleading.

In reality, ARB’s estimate of excess cancer risks is based on upper bound cancer potency estimates derived for individual compounds that by design overstate likely risks. Actual cancer risks are likely to be far below upper bound estimates, and could be zero, as has been recognized by ARB and EPA in connection with numerous cancer risk assessments for individual compounds. Because the Draft Report fails to disclose this important information, it gives the reader a very misleading picture. The discussion of potential cancer risks should be substantially revised to provide a more objective and transparent discussion of likely cancer risks from low level exposures to VOCs in indoor air.

A more balanced discussion would lead to the conclusion that any excess cancer risks are limited to a relatively small number of compounds, and even for these compounds, risks likely are far below upper bound estimates and could be zero. Such a conclusion would invite

more focused research to determine whether cancer risks may indeed be elevated for some compounds based on current use information, and more focused risk reduction measures targeted specifically to those substances, if any, that are shown to pose significant risks.

The upper bound nature of cancer risks estimates is discussed at length in an article cited in the Draft Report by Lance Wallace of U.S. EPA's Atmospheric Research and Exposure Assessment Laboratory (Wallace, 1991). Wallace calculated potential cancer risks from exposure to indoor and outdoor air. He identified 10 VOCs and 8 pesticides that were estimated to pose greater than a one-in-a-million excess cancer risk in indoor air (including some products that have been banned from consumer products or banned altogether). However, he expressly acknowledged that his risk calculations were based on upper bound potency estimates derived from animal studies.⁵ Wallace described two studies that show that upper bound potency estimates typically are seven to ten-fold higher than mean potency estimates, and he therefore concluded that his upper bound estimates "may be divided by a factor of 7 or 10 to provide best estimates of risk . . ." (p. 9).

Further, Wallace expressly acknowledged, "For some of these chemicals, it is also possible to argue that the best estimate of risk is 0." (*Id.*) Wallace provides a discussion of uncertainty that is missing in the Draft Report. Thus, he states:

Great uncertainty accompanies most risk estimates. The major uncertainties involved in potency calculations are well known: the extrapolation from animals to man and from high dose to low dose. These uncertainties are such that a given chemical may not cause human cancer at all; the actual cancer risk may be exactly 0. Even if the risk is not 0, the estimates could easily be wrong by factors of 10, 100, or more, depending on the shape of the dose-response curve, the possible existence of a threshold due to DNA repair or other mechanisms, and many other factors. [pp. 9-10]

The above quote from Wallace (1991) recognizes that cancer risk assessments based on mean cancer potencies are also conservative, because they assume animal-to-human relevance and high-to-low dose linearity. Thus, they also by design likely overstate actual human cancer risks, particularly from the low exposures typically found in indoor and outdoor air. True risks may be zero, and if not zero, could be 10 or 100-fold below mean estimates.

The Draft Report should include similar discussion of the uncertainties inherent in its estimates of potential excess cancers and associated costs. The upper bound nature of ARB's estimates should be clearly disclosed. The Report should recognize that "best estimates" based on mean cancer potencies could be 7-to 10-fold lower, and true risks could be lower still and could be zero. Such revisions would give the Report much needed transparency and objectivity,

⁵ Wallace notes that the benzene cancer risk assessment is based on human epidemiology data and hence supports a maximum likelihood estimate.

and would provide the state legislature and other interested parties with a more credible and scientific basis for evaluating potential health concerns associated with indoor air.

III. INFORMATION PRESENTED ON INDOOR AIR CONCENTRATIONS OF VOCs IS INCOMPLETE AND MISLEADING; AVAILABLE DATA INDICATE MOST COMPOUNDS ARE PRESENT AT VERY LOW LEVELS AND ARE UNLIKELY TO POSE SIGNIFICANT HEALTH RISKS

Assembly Bill 1173 calls upon ARB to present the best available empirical data on indoor air concentrations of substances that may pose health risks.⁶ The Draft Report falls short of this mandate with respect to most VOCs that are addressed. Very limited information on indoor air concentrations is presented, and the Draft Report in most cases fails to compare indoor air concentrations to relevant health benchmarks, so the reader is given no basis for assessing the health significance of reported concentrations. When specific references cited by ARB are consulted, it becomes apparent that most VOCs typically are detected in indoor air at low part per billion levels that are unlikely to pose significant health risks. Even these references may give a misleading impression of *current* indoor air levels, because many of the references are relatively old, and significant changes to many product formulations have occurred over the last ten years.

A handful of VOCs have been detected at median levels that might present a cancer risk above one in a million, but as noted previously, these assessments are based on upper bound estimates of potential cancer risks, and actual risks are likely to be much lower and could be zero. Thus, when available empirical data on indoor air concentrations are presented and compared to relevant health benchmarks, the assessment indicates that the vast majority of VOCs for which data are available are unlikely to pose significant health risks. The Draft Report should display this information so intended audiences can get a more complete and objective picture of the scope of potential concerns pertaining to VOCs that have been measured in indoor air.

The Council has not had an opportunity to review every reference cited in the Draft Report, but the following paragraphs should be sufficient to demonstrate that sections 2.3.2.2 (Sources and Emissions of VOCs) and 2.3.2.3 (Indoor Concentrations of VOCs) should be substantially rewritten to provide a more complete and objective report on indoor air concentrations of VOCs and their potential health significance.

1. The Draft Report (p. 55) discusses toluene use in consumer products and reports that in one study “Estimated maximum concentrations and daily doses were high, up to 4000 µg/day,” and that in another study of non-smokers’ homes toluene was detected at 24 µg/m³ in homes with an attached garage, and 5 µg/m³ in homes without an attached garage. No

⁶ See AB 1173, Section 2 (directing ARB to provide to the Legislature a report summarizing, among other information, “The best scientific information available including, but not limited to, the most recent empirical data, on indoor air pollution . . .”).

comparison is made to relevant health benchmarks. In fact, California OEHHA has promulgated a chronic reference exposure level (REL) for toluene of $300 \mu\text{g}/\text{m}^3$. Since this value is intended to be protective for the general population assuming continuous exposure for a lifetime, the concentrations reported in the second study clearly are well below levels of concern. A comparison of the estimated maximum dose of $4000 \mu\text{g}/\text{day}$ in the first study can be made to the chronic REL by assuming an inhalation rate of $1.3 \text{ m}^3/\text{hr}$ for 24 hours, resulting in a estimated exposure of $9360 \mu\text{g}/\text{day}$ (assuming exposure at the chronic REL level for 24 hours). This comparison shows that the maximum reported dose is in fact well below the safe level for chronic lifetime exposure calculated by OEHHA. Of course, one would not expect the maximum value reported in the article to be repeated daily for a lifetime. Further, in December 2003, the U.S. EPA proposed an inhalation reference concentration (RfC) for the EPA's Integrated Risk Information System (IRIS) database of $13,000 \mu\text{g}/\text{m}^3$, which translates into $405,600 \mu\text{g}/\text{day}$ using the above inhalation rate. This newly proposed RfC is based on an extensive database of human epidemiology and animal toxicology data and in setting the RfC EPA noted high confidence in the inhalation database for toluene. Thus, the information presented in this portion of the Draft Report is not indicative of any significant health risks and the report should be appropriately modified.

2. The Draft Report (p. 56) reports average chloroform concentrations during and immediately after a shower of 67 to $265 \mu\text{g}/\text{m}^3$. The Report fails to disclose that CA OEHHA has promulgated a chronic REL of $300 \mu\text{g}/\text{m}^3$. Further, the study cited by ARB (Kerger, *et al.*, 2000) calculates a total oral and inhalation dose of $2.65 \mu\text{g}/\text{day}$, compared to an EPA IRIS oral reference dose (RfD) of $10 \mu\text{g}$ per kilogram of body weight per day. For a 70 kg adult, the RfD is more than 250-fold above the exposure estimated by the authors. Thus, the information presented by ARB is not indicative of a significant health risk.

3. The Draft Report in several places (e.g. pp. 58, 60) emphasizes that indoor air concentrations of VOCs (and other compounds) often exceed outdoor air concentrations. This conclusion seems well-supported by available data, and it supports the equally non-controversial conclusion that indoor air concentrations are attributable in part to indoor sources (and are not due solely to infiltration of outdoor air). However, the important questions are these: are indoor air concentrations above levels of concern for any VOCs, and if so, for which ones and by how much? A comparison to outdoor concentrations does not answer those questions, and thus does not provide any basis for assessing the need to take risk reduction measures with respect to sources of indoor air exposures to any VOCs

4. Another example of the need to put indoor exposure levels in context with recognized assessments of the degree of toxicity is butoxyethanol (BE). The Draft Report (at p. 57) notes indoor exposure assessments conducted by Zhu, *et al.*, based on emissions from use of BE-containing cleaning products measured in a field and laboratory emission cell. Zhu conducted these studies because of the paucity of actual indoor exposure monitoring. The highest average daily exposure level Zhu determined (many of the levels determined for other BE-containing products were much lower) was $0.186 \text{ mg}/\text{kg}$ body weight/day (or $13.2 \text{ mg}/\text{day}$ for a 71 kg person). Not mentioned in the Report is the large margin of safety between this

maximum concentration level and exposure levels found not to pose appreciable risk by both U.S. EPA and California.

EPA has established an inhalation reference concentration (RfC) for BE of 13 mg/m³. This is the level EPA deems “without an appreciable risk of deleterious effects during a lifetime” even for sensitive subgroups. See: <http://www.epa.gov/iris/subst/0500.htm>. For a person breathing 1.3 m³/hour for 24 hours a day, that RfC translates to 405.6 mg/day.

Thus, the high-end exposure concentration mentioned in the California Draft Report is less than 1/30th (13.2 vs. 405.6) the level deemed not to pose appreciable risk. California currently does not have a chronic REL for BE; but, in 1998 OEHHA proposed a value of 10 mg/m³, which would be 23 times (13.2 vs. 302) the highest Zhu concentration level.

Combining exposure assessments for BE like that conducted by Zhu, *et al.*, with accepted toxicity assessments indicates indoor exposures to BE should not be of concern. The Draft Report should provide that perspective.

5. The Draft Report (p. 58) describes a study by Girman *et al.* (1999) of indoor air concentrations of many VOCs in typical office buildings. The Report summarizes frequency of detection information and lists the 12 VOCs with the highest median indoor air concentrations, but data on actual concentrations are not reported, even though extensive information is presented in the published article. Median indoor air concentrations in fact were below 10 µg/m³ in all but one case – acetone (29 µg/m³), which is not listed as a toxic air contaminant in California. The U.S. Agency for Toxic Substances and Disease Registry (ATSDR) has derived a chronic minimal risk level (MRL) for acetone of 13 ppm (31 mg/m³, or 31,000 µg/m³), which is more than 1000-fold above the median value reported by Girman. Even the high value reported for acetone (220 µg/m³) is more than 100-fold below the airborne concentration ATSDR considers to be without appreciable risk assuming continuous exposure for a lifetime. The median values reported by Girman for toluene and m- & p-xylenes, are 9 and 5.2 µg/m³, respectively, compared to CA OEHHA chronic REL values for these compounds of 300 and 700 µg/m³, respectively. The range of values reported for 2-butanone (methyl ethyl ketone, or MEK) was 0.7 to 18 µg/m³, compared to an IRIS inhalation RfC of 5,000 µg/m³. Indoor air levels for ethyl acetate ranged from 0.22 to 65 µg/m³; these values are trivial compared to chronic oral RfDs in IRIS of 0.9 mg/kg/day.⁷ Thus, at least for these oxygenated and hydrocarbon solvents, the report demonstrates that indoor air concentrations are well below levels that ATSDR, OEHHA or EPA would conclude might pose health concerns. It is important that this information be reported fully and objectively in the Draft Report, so that the reader can make a sound assessment of the nature and scope of any indoor air concerns.

⁷ For a 70 kg adult, an RfD of 0.9 mg/kg/day equates to a “safe” daily dose of 63 mg/day. A maximum indoor air concentration of 65 µg/m³ equates to a daily exposure of just over 2 mg/day, assuming inhalation of 1.3 m³/hour for 24 hours. As stated earlier with respect to toluene, one would not expect exposure to be repeated daily at the maximum measured level for a lifetime.

6. Table 2.7 and Figure 2.5 in the Draft Report do present air concentration information, but no comparison to relevant health benchmarks is presented. In fact, for every compound for which a chronic REL is available, reported median indoor air concentrations are below that REL by at least a factor of 10, and sometimes by a factor greater than 100.⁸ Some of the compounds are classified as known, probable or possible carcinogens, and thus an additional assessment of potential cancer risks is necessary, but no such analysis is presented. As already noted, any such analysis should explicitly recognize the upper bound nature of the underlying cancer potency estimates. (See discussion of Wallace (1991) in section II of these comments).

7. Other studies described in the Draft Report provide additional data on indoor air concentrations of a wide variety of compounds (Brown *et al.*, 1994; Sheldon, *et al.*, 1992; Shield *et al.*, 1996), but the information is not included in the Draft Report. The studies paint a fairly consistent picture: median indoor air concentrations of measured VOCs typically are very low, in the single-digit $\mu\text{g}/\text{m}^3$ range. For the vast majority of compounds, there is no scientific basis for believing these low levels pose any measurable, significant human health hazards. Potential hazards may exist for a small subset of compounds classified as known or probable carcinogens, based on upper bound potency estimates but as stated previously, actual cancer risks likely are far below estimated risks, and could in fact be zero.

IV. THE PRIORITIZATION SCHEMES PRESENTED IN THE DRAFT REPORT SHOULD BE REVISED

The Council believes the prioritization schemes presented in the Draft Report need to be revised substantially to provide a more balanced and objective assessment of potential priorities for further research and/or risk reduction measures.

Environmental tobacco smoke clearly should be a higher priority than is indicated in tables in the Draft Report, and much more attention should be given to biological agents, as well. This comment pertains to Table ES-1 (p. 3), Table ES-3 (p. 17) and similar tables in the main text (e.g., Table 6.1, p. 124). "Organic chemicals" are inappropriately lumped into a single category of "pollutants" in Table ES-1, when of course organic chemicals are not a single category at all, and it is clearly not appropriate to label all organic chemicals as "pollutants." Further, in Table ES-3, which sets forth a "prioritization of pollutant sources for mitigation," "building materials and furnishings" and "consumer products" should not be treated as single categories when they clearly represent a wide range of products that comprise literally hundreds of very different categories and subcategories. These overly broad categories should be subdivided into smaller categories of related products.

⁸ It is important in this context to understand that an occasional excursion above a chronic REL or IRIS RfC does not necessarily mean there is any health risk. These values are based on conservative methodology and are intended to represent exposures that can be continued for a lifetime without appreciable risk. While exposures below these levels are generally regarded to be safe, exposures above these levels may not pose any significant health risks, particularly if they occur infrequently or for short periods of time.

Further, the prioritization scheme should distinguish between high, medium and low priorities, and no product or group of products should be in a “high priority” category without some demonstration that exposures exceed or can reasonably be anticipated to exceed relevant health benchmarks. The Draft Report does not identify any criteria used to identify high priority sources, or to establish relative priorities among different sources of indoor air exposures. Such criteria should be made clear, and should be designed to incorporate information on hazard and exposure to support rigorous and credible risk characterizations.⁹

V. ADDITIONAL TECHNICAL COMMENTS

1. The statement that “indoor levels of volatile organic chemicals (VOCs) and some other pollutants are typically elevated” (p. 8) is not informative and should be corrected. Elevated compared to what? Similar statements appear elsewhere in the document.

2. Table ES-2: Costs pertaining to ETS dominate the table and should be presented separately.

3. The following statements are found on p. 18: “Consumer products, architectural coatings, and personal care products have been regulated to reduce emissions of reactive VOCs in order to reduce smog formation. Further restrictions to assure reduction of toxic air contaminants and nonreactive VOCs with potential health implications appear warranted.” The latter sweeping statement is overly broad and largely unsupported by the Draft Report. The text gives the impression that wholesale changes are required, but there is no data to support that suggestion. Sweeping generalizations should be replaced with statements that focus on specific products or chemicals, and that are supported by hard data about uses, exposures and comparisons to relevant health benchmarks.

4. Table 2.4 (Common Carcinogenic Indoor Air Pollutants) should not include compounds classified by EPA as “Group D, not classifiable.” It is equally inappropriate to list styrene in the table simply because it is “under consideration.” The information about DEHP needs correction (see separate comments submitted by the ACC Phthalate Esters Panel). If Group C compounds are to be included in the table, then the heading should be changed to “Chemicals Classified as Known, Probable or Possible Carcinogens.” The amount of information sufficient to classify a chemical as a “possible” carcinogen often is not sufficient to warrant regulation on that basis, and does not justify calling a compound a “common carcinogenic indoor air pollutant.”

5. The statement is made (p. 58) that “Four of the most abundant 12 VOCs [in the Girman *et al.* study] are oxygenated, which may indicate greater potential to cause irritant effects.” No support is provided for this statement, and we are aware of no scientific basis for implying that all oxygenated compounds have “greater potential to cause irritant effects.” Further, we are not aware of any evidence that irritation might be caused by exposures

⁹ The discussion of priorities for action to address concerns in schools is considerably more balanced and focused than other parts of the Draft Report.

at the low levels reported in this study. Certainly available health benchmarks do not support this statement. For example, the AEGL-1 value for acetone is 200 ppm, more than 10,000-fold above the median air concentration for acetone reported by Girman *et al.*

6. Texanol® is a registered trademark of the Eastman Chemical Company for their brand of 2,2,4 trimethyl-1,3-pentanediol monoisobutyrate. All references to Texanol® should be corrected.

7. Page 57, 2nd paragraph discusses emissions of TACs from paints and notes that a number of compounds, including propylene glycol have been studied. Since propylene glycol is not a TAC it should be removed from the list of chemicals.

CONCLUSION

The Council appreciates the opportunity to submit these comments. As stated at the outset, the Council appreciates the extensive effort the ARB staff put into the development of the Draft Report. The Council recognizes the importance of the Report, and the importance of identifying any indoor air exposures that may be contributing to adverse health effects, particularly in schools. At the same time, it is important not to overstate the urgency of the issue or to paint with too broad a brush. Research and risk reduction measures should be directed at exposures that are a high priority based on reliable, current data demonstrating a significant health concern. The Council is submitting these comments to support that objective, and respectfully urges ARB to make the revisions to the Draft Report suggested herein.

If you require additional information or have questions concerning these comments, please contact me at (703) 741-5609 or by e-mail at:
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Sincerely,



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